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Is Ancient DNA Research Revealing New Truths — or Falling Into Old Traps?

Geneticists have begun using old bones to make sweeping claims about the distant past. But their revisions to the human story are making some scholars of prehistory uneasy.

By Gideon Lewis-Kraus

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PART I

1. The Ghosts of Teouma

A faint aura of destiny seems to hover over Teouma Bay. It's not so much the landscape, with its ravishing if boilerplate tropical splendor — banana and mango trees, coconut and pandanus palms, bougainvillea, the apprehensive trill of the gray-eared honeyeater — as it is the shape of the harbor itself, which betrays, in the midst of such organic profusion, an aspect of the unnatural. The bay, on the island of Efate in the South Pacific nation Vanuatu, is long, symmetrical and briskly rectangular. In the expected place of wavelets is a blue so calm and unbroken that the sea doesn't so much crash on the land as neatly abut it. From above, it looks as though a safe harbor had been engraved in the shoreline by some celestial engineer.

In late 2003, while clearing land just above the seaside, a bulldozer driver found a broken piece of pottery in the rubble. The villagers of Vanuatu often happen upon shards of timeworn ceramic, which spark an idly mythical curiosity; they're said to

be fragments of Noah's Ark, or the original Ten Commandments, or the burst water vessels of powerful ancestral spirits. These shards are often left alone, but word in this particular case traveled quickly, and the artifact soon found its way to the Vanuatu Cultural Center and National Museum, where Stuart Bedford, a New Zealand archaeologist who had studied local pot shards for years, was called in to inspect it. He immediately recognized its distinctive pattern — "dentate stamping," an ancient technique so named because it looked as though some tiny-toothed creature had bitten an intricate pattern into the ceramic — and understood that this pottery coincided with the very first movement of ancient peoples into the South Seas.

Bedford rushed to the site of the discovery, an old colonial coconut plantation that the bulldozer had been clearing for use as a prawn farm. Further burrowing turned up not only more pottery but also tools of obsidian and a great cache of human bones, which had lain undisturbed and unusually well preserved over thousands of years. The site was soon identified as the oldest and largest prehistoric cemetery ever found in the Pacific. Everything at the site indicated a founding colony — first arrivals to the shores of uninhabited islands. Teouma was, according to Bedford, "unlike anything anyone had ever seen, or was likely to see, in this part of the world ever again."

Archaeologists hoped the bones might help provide a clue to the abiding mystery of how anybody had gotten to these far-off coastlines in the first place. Vanuatu is a volcanic archipelago of more than 80 islands littered in an extended slingshot shape across an 800-mile arc of the South Pacific. Europeans first heard of its existence in 1606, when a Portuguese navigator stopped through on a brief but violent imperial errand for the Spanish crown. The islands were largely left to their own devices until the end of the 18th century, when French and British ships arrived to plant their own flags. The two countries ruled the archipelago as a joint colony, called the Condominium of the New Hebrides, until independence was achieved in 1980. National coherence remains a work in progress. By some measures, Vanuatu is per capita the most linguistically diverse country on the planet: Its quarter-million citizens, predominantly the native ni-Vanuatu, speak as

many as 140 different indigenous languages and maintain an astonishing variety of cultural practices. A meaningful national identity has been constructed from a common appreciation of ceremonial pig-tusk bracelets and the taking of kava, a very mild narcotic root that looks like primordial pea soup and tastes like a fine astringent dirt. Above all, however, the ni-Vanuatu are bound together by the fact of the country's nautical isolation: Their nearest neighbors are hundreds of miles in any direction.

It is the peculiar geography of this isolation that made the Teouma site so significant. Many of the islands of the South Pacific are much farther-flung: Easter Island makes Vanuatu look like an Australian exurb. But with one very small exception — the tiny eastern outliers of the Solomon Islands — Vanuatu offers the first solid ground on the far side of a major but invisible maritime boundary. On the west side of that border is a string of archipelagoes called Near Oceania: islands chained to one another (and to the rest of the world) by lines of sight. Prehistoric peoples, after tens of thousands of years of travel by foot from Africa, had arrived at the end of Southeast Asia and hopscotched their way forward via short sea outings, presumably crossing the narrow channels they encountered on crude watercraft. Finally, however, some 40,000 years ago, their path was decisively blocked by open ocean. In front of them, across more than 200 miles of empty sea, was the vast aquatic wilderness of Remote Oceania.

[5 takeaways from this report on ancient DNA research.]

That border marked the absolute limit of human expansion for tens of thousands of years, until at last someone sailed out across the naval event horizon and into the unknown. This first traversal was one of the greatest and most courageous passages in human prehistory. The peopling of Remote Oceania — an obscure exodus that easily ranks among the signal triumphs of the ancient world — has inspired awe and vexation for generations. In the mid-20th century, archaeologists came to identify these first voyagers with a set of jars and tools unique to the region, the "Lapita cultural complex," and determined that they crossed the boundary into Remote Oceania some 3,000 years ago. Further details were presumed lost to history.

But in 2014, Bedford got another surprise call, this time from a researcher affiliated with a genetics team at Harvard. A small group of pioneering lab scientists had found ways to isolate and analyze DNA from ancient bones, methods potent enough to inspire a wholesale revision of our knowledge about ancient peoples. The Harvard operation, which was then preparing a landmark paper about European origins, now intended to visit their attention upon the South Pacific, and they wanted to know whether Bedford might facilitate access to the Teouma remains. Bedford agreed, and over the next four years, the Harvard team used the DNA they found to present a radical new story about Remote Oceania's first settlers.

Bedford and I met last summer in the hilly and sedate capital of Port-Vila, outside the towering thatched A-frame of the national museum. He is tall and friendly, with a square head, short brown hair, a rancher's open gait and the incessant squint of someone in perpetual communion with the near-hopeless complication of human affairs. We climbed into his white Land Cruiser and drove to a tidy village compound outside town. There, Bedford embraced the local chief, Silas Alben, who led us through village gardens of banana and tuber to a high limestone cliff with a sprawling view of the Teouma site.



Silas Alben, the chief of the village that includes the Teouma site, where the ancient remains were found. David Maurice Smith for The New York Times

As we shared the sweating neon flesh of a machete-split papaya, Bedford, now affiliated with the Australian National University, ran through all the reasons that the sheltered cove far below — just then rippling beneath a late-afternoon rainbow — would have made an inviting stage for the encounter of an ancient people with a primeval place. For whoever arrived in those first canoes, these empty islands offered a bounty of unfished reefs, unoccupied land and naïve, slow-moving animal prey; for those who now studied those first colonists, their arrival represented an important inflection point in human expansion and development. And now, the science of “paleogenomics” had coaxed new stories of ancient lives from the Teouma bones.

2. Prehistory: A History

For most of human history, our beliefs about our origins drew upon oral traditions or the evidence found in ancient texts. One 17th-century scholar calculated, on the basis of biblical genealogies, that the creation happened in 4004 B.C.; subsequent refinements settled on the date of Oct. 23. Sir Isaac Newton criticized the ancient Egyptians for the "vanity" of their own calendrical reckoning, which placed the beginning of their monarchy before the existence of the world. As the pre-eminent British archaeologist Colin Renfrew once put it, "For an educated man in the 17th or even the 18th century, any suggestion that the human past extended back further than 6,000 years was a vain and foolish speculation."

It wasn't long before a series of scientific interventions pried open human prehistory to methodical study. Two great advances of 1859 helped cement the view that 4004 B.C. was not, in fact, the starting point of all human activity. The first was the argument, made by a geologist and an antiquarian, that animal remains found alongside stone tools in Britain and France proved the antiquity of the human race. The second was the publication of Darwin's "On the Origin of Species," which was incompatible with both the specifics of biblical creationism and the more general proposition that the world was only a few thousand years old. It was all of a sudden widely plausible that stuff in the ground had been there for an unimaginably long time.

Before anyone could even begin to tell an ordered story about what might have happened, however, there needed to be a way to differentiate what happened sooner from what happened later. In the early 20th century, geologists and archaeologists began to draw upon contemporary observations of regular sedimentary deposits to project elementary prehistorical "clocks" backward in time. The end of the last ice age, for example, was set at about 10,000 years ago. Archaeologists then realized that they could cross-reference these geological clocks with the earliest written documents, ancient Egyptian and Mesopotamian records that reached back 4,000 or 5,000 years. If geological time could be roughly

calibrated everywhere, and if even a smattering of places had left behind calendars, recorded history could be tied to sedimentary chronology and true dates derived from the ground.

This was heralded as a magnificent advance. The trouble, as it turned out, was that an emphasis on written records from Egypt and the Middle East prompted scholars to take for granted the cultural superiority of those early civilizations and to make major assumptions on that basis — Stonehenge, for example, simply had to have followed the majesty of the Great Pyramids.

In 1949, the invention of radiocarbon dating, by the American physical chemist Willard F. Libby, turned the whole field upside down. By giving cosmically certain dates rather than cross-referenced estimations, radiocarbon dating undermined virtually all of archaeology's basic premises. (Stonehenge could not have been patterned after the Great Pyramids if it was built at the same time as Giza.) There was stubborn resistance to the new lab results. These dates, pronounced one vaunted Edinburgh archaeologist with a now-notorious sniff, are "archaeologically unacceptable." By the early 1960s, they could no longer be ignored, and a new generation of archaeologists gutted the discipline and rebuilt it with very different assumptions — ones that did not rely on the idea that a few peoples of first-rate culture and pedigree had been responsible for humanity's major steps forward.

If prehistorians had learned one hard lesson from chemists, their colleagues in biology departments were slowly laying the groundwork for another. In 1967, the molecular biologist Allan Wilson at the University of California, Berkeley, along with one of his students, Vincent Sarich, demonstrated that evolutionary relationships between species could be determined not only from fossils but also, via a quantitative analysis of blood proteins, from living specimens. Humans and apes, Wilson found, diverged only five million years ago — far more recently than previously believed.

Within the decade, researchers trained in the discipline of population genetics would get in on the historical act. Every contemporary genome is a mosaic of individual tiles passed along from thousands of ancestors; each of us thus contains

not only our “own” ancestry but those of multitudes. With each new generation, random mutations, like misspellings, are introduced into a population; some of these will disappear over time, but others will increase in frequency until they are common enough to become a statistically significant part of a population’s genetic signature. If two populations have been distinct for a long time — that is, if people from one don’t tend to mate with people from the other — they will share fewer of these mutations; if they encountered each other and were fruitful, their mutation frequencies will overlap. These insights could be made relevant to prehistorians insofar as they could demonstrate that modern human populations were forged in the mixture of ancient ones. It was still mostly impossible, though, to conclude anything about when these groups might have mixed, or where, or how.



A storage room in the Vanuatu Cultural Center and National Museum. David Maurice Smith for The New York Times

The answers to those questions required not just contemporary genetic data but actual prehistoric DNA. The idea that it might be preserved in old specimens has been around since 1984, when Wilson announced that his lab had extracted DNA from the salted skin of a quagga, an extinct equine species with the head of a zebra and the haunches of a donkey. The further possibilities suggested by ancient DNA were awarded a special place in the public imagination by the 1993 release of Steven Spielberg's "Jurassic Park." But even as the journal Nature capitalized on the premiere with a paper that sequenced the DNA of an amber-trapped weevil — a study rendered dubious after widespread speculation that the sample had been contaminated with the researchers' own DNA — observers wondered whether the sequencing of ancient genomes was just a neat trick or research of actual value.

Over the past few years, a growing cohort of scientists has at last produced a fantastic answer. Ancient DNA, they believe, not only allows us to cut through what scholars once wrote off as "wrapped in a thick fog" of "heathendom." It promises nothing less than what the Harvard geneticist David Reich has called "the genome revolution in the study of the human past."

3. The Revisionist

David Reich's lab is folded into a corner of a glassy, long-corridored labyrinth at Harvard Medical School. The only exterior advertisements of the nature of his research are large mounted maps of landforms all around the world. One afternoon last fall, as I stood and examined a continent, Reich materialized beside me. He is a long-limbed man with a lithe, almost balletic figure, and he wore a closefitting pullover and fading coral chinos. Though his hairline has receded and the curls behind his ears are graying, a boyish precocity makes him seem much younger than his 44 years. He led me swiftly past a confab of postdocs and into his windowed office. There was very little in the way of adornment, save a ghostly, truncated branch of the Indo-European language tree ("Greek," "Armenian") that someone had sketched out, on the wall over his desk, with what looked a permanent marker.

In his recent book, Reich ranks the “ancient-DNA revolution” with the invention of the microscope. Ancient DNA, his research suggests, can explain with more certainty and detail than any previous technique the course of human evolution, history and identity — as he puts it in the book’s title, “Who We Are and How We Got Here.” Though Reich works with samples that are thousands or tens of thousands of years old, the phrase “ancient DNA” encompasses any old genetic material that has been heavily degraded, and Reich’s work has been made possible only by a series of technological and procedural advances. Researchers in the field ship or hand-carry the bones to Harvard, where clean-suited technicians expose them to ultraviolet light to prevent contamination, then bore holes in them with dental drills. These skeletal remains are often rare — one pinkie-finger fragment that researchers in a lab in Leipzig used to demonstrate the existence of a long-extinct form of archaic humans was one of only four such bones ever found. Minuscule portions of genetic code are isolated and enriched, then read by expensive sequencers; statistical techniques then plot the relationship between this particular sample and thousands more in enormous data sets.

Reich inherited from his parents a humanistic bent: His mother, Tova, is a novelist of some renown; his father, Walter, is a psychiatrist who was the first director of the United States Holocaust Memorial Museum in Washington. He entered Harvard with an inclination toward social studies, but halfway through, in pursuit of greater rigor, he switched to physics; after graduation, he went to Oxford, where he studied biochemistry with the idea that he might go on to medical school. The impression he gives when talking about these years is one of restless intellectual ambition in search of a commensurate object. He eventually returned to Oxford to complete a doctorate, in zoology, where he at last found a sense of belonging in the lineage of Luca Cavalli-Sforza, a population geneticist who spearheaded efforts to make historical inquiry resemble a hard science.

After abandoning medical school at Harvard for a postdoc at M.I.T., Reich returned to Harvard to establish his own medical-genetics lab. His chief interest lay in the effort to design novel statistical approaches to better explain how populations were related to one another. He showed, for example, on the basis of contemporary

genetic data, that modern Indians are in fact a product of two highly distinct groups, one that had been on the subcontinent for thousands of years and another that formed more recently.

He got his first opportunity to study ancient DNA when Svante Paabo — a Swedish geneticist who had worked with Wilson — enlisted Reich in his efforts, based out of a lab in Leipzig, to sequence the entirety of the Neanderthal genome. Reich's analysis helped demonstrate that most living humans, with the general exception of sub-Saharan Africans, have some Neanderthal ancestry. "It was clear with the sequencing of the Neanderthal," Reich told me in his office, "that this was obviously the best data in the world in any type of science." It didn't just tell you that Indians were a mixed group; it could, in theory, specify the moment where and when that mixture began.

So in 2013, Reich, along with a veteran of Paabo's lab and a longtime mathematician collaborator, retooled his shop at Harvard Medical School as one of the country's first dedicated ancient-DNA labs. The idea, he writes in his book, "was to make ancient DNA industrial — to build an American-style genomics factory" that would liberate such fields as archaeology, history and anthropology from hitherto insoluble debates.

He was more successful than even he anticipated. By the end of 2010, only five ancient genomes had been sequenced in total, but in 2014, 38 were done in one year. Soon the number will be close to 2,000. Reich's lab alone is responsible for at least half of the published output, which doesn't include some 5,500 more bones in the process of being analyzed and 3,000 more in storage. "Ancient DNA and the genome revolution," he declares in his book's introductory overture, "can now answer a previously unresolvable question about the deep past: the question of *what happened*."

4. What Happened?

Everybody pretty much agrees that the story of what happened began in Africa, with the evolution of modern humans; later, as of 50,000 to 100,000 years ago, the human story continued on the other continents. As Reich sees it, the study of ancient DNA has disproved our conjectures about what happened next. One longtime premise is that as these early humans spread out in all directions over the land, groups of them encountered places that struck their fancy, pitched their tents and more or less stayed "home" for the duration of prehistory. This is not just a pet theory of academic prehistorians but the natural way that human beings have tended, over the millenniums, to connect their identities to where they live. The ni-Vanuatu, for example, take for granted their eternal ties to the archipelago; their oral traditions ascribe their origins to some nonhuman feature of the landscape, their first ancestors having emerged from a stone, say, or a coconut tree. Nonindigenous people seek the same rootedness in consumer ancestry services like 23andMe, which declare that they're "Spanish" or "Yoruba."

Reich believes he has proved, to the contrary, that human history is marked not by stasis and purity but by movement and cross-pollination. People who live in a place today often bear no genetic resemblance to people who lived there thousands of years ago, so the idea that something in your blood makes you meaningfully Spanish is absurd. Paabo had shown that early humans mated with Neanderthals, but that was only one small part of the swirling "admixture" that characterized human interbreeding. Even after the Neanderthals became extinct, roughly 40,000 years ago, the archaic human populations of the earth — Reich gives them names like Ancient North Eurasians — were utterly unlike the populations we see today.



David Reich, who runs an ancient DNA lab at Harvard Medical School. Kayana Szymczak for The New York Times

While Paabo continued to work on the Neanderthal period, Reich devoted his energy to obtaining samples from the last 10,000 or so years — the historical domain of archaeologists. Ancient DNA's "big bang," as more than one geneticist described it to me, came with the 2015 publication, in Nature, of a Reich paper called "Massive Migration From the Steppe Was a Source for Indo-European Languages in Europe." On the basis of genetic information culled from 69 ancient individuals dug up by collaborating archaeologists in Scandinavia, Western Europe and Russia, the paper argued that Europeans aren't quite who they thought they were. About 5,000 years ago, a "relatively sudden" mass migration of nomadic herders from the east — the steppes of eastern Ukraine and southern Russia — swept in and almost entirely replaced existing communities of hunter-gatherers

and early farmers in Central and Northern Europe. These newcomers were known to exploit many of the cutting-edge technologies of the time: the domestication of horses, the wheel and, perhaps most salient, axes and spearheads of copper. (Their corpses sometimes featured cutting-edge wounds.)

The Reich team inferred that the major source of contemporary European ancestry — and probably Indo-European languages as well — was not, in fact, from Europe but from far to the east. And this discovery, confirmed by the near-simultaneous publication of almost identical results from a competing ancient-DNA lab in Denmark, had monumental implications for science's understanding of the whole ancient world. Great migration events — like the movement of Siberian peoples into North America or the spread of voyagers into the Pacific — were not outliers but the norm. After Europe and India, there were similar mass migrations identified in Africa, the Middle East and Southeast Asia. No one ever expected that we could possibly amass so much new evidence about the human past. And no one was producing this work at the pace and throughput of David Reich and his genomics factory. Most scientists felt lucky if they published one or at the most two Nature papers in a lifetime. Reich was publishing three or four a year.

There was an obvious pattern to the great migratory arrows freshly drawn across world geography, which were often coincident with the spread of technology or agricultural practices. Earlier paleogenomic results established thousands of years of heady mixture among long-forgotten ancient populations. With the relatively recent rise of everything we associate with "culture" — technologies like agriculture, metallurgy and eventually writing — much of this continuous "admixture" began to give way, it seemed, to discontinuous episodes better characterized as "replacement" or "turnover." That is, about 5,000 to 9,000 years ago, human history was, at least in a few crucial places, less about various groups coming together and more about some groups blotting out their neighbors.

This was not only relevant as an eccentricity of prehistoric demography, but broadly consequential for the ongoing study of culture itself — of where new ideas come from and how they proliferate. When we thought of populations as stationary and largely stable, we assumed that whatever evolutionary progress they made,

from toolmaking to agriculture, reflected either a native innovation or the incorporation of some adjacent group's avant-garde practice. Now it seemed as though culture was less about the invention and spread of new ideas and more about the mass movements of particular peoples — and the resulting integration, outcompetition or extermination of the communities they overran. Previously, it was possible to think about prehistory as a kind of grand bazaar. Now the operative metaphor (as multiple science journalists observed) was more like Risk, or even "Game of Thrones."

5. Looking for the Lapita

The ancient-DNA revolution seemed unlikely to have anything to say about Oceania, where the heat and humidity made the preservation of DNA implausible. But in 2014, Stuart Bedford got that second surprise call, from a Dublin-based archaeologist named Ron Pinhasi, a frequent Reich collaborator and procurer of samples. Pinhasi had discovered that the inner ear's petrous bone, one of the densest in the body, often preserved vast quantities of genetic material. Could he and Reich examine the skulls of Teouma? In Vanuatu, human remains are often associated with ancestral spirits and are thus taboo — understandably, Bedford emphasized to me, explaining that he wouldn't be comfortable digging up and boring into "Granddad." But in this case, the ni-Vanuatu expressed no reservations: Local oral traditions contained no sacred reference to the Teouma dead, and Chief Alben gave his blessing. One of Bedford's colleagues opened the skulls in a workshop warren behind the national museum, extracted the nubbins of petrous bone and shipped them to Dublin, where they were sandblasted. There turned out to be DNA in three of the samples. It was the first to be found in the tropics and suggested the opening of wide new fronts in ancient-DNA research.

The skulls of Teouma were particularly interesting to paleogenomicists not only because they produced the first ancient DNA in the Pacific but because their genetic evidence could be brought to bear on an outstanding debate in the region. The pivotal moment in Pacific archaeological history happened in 1952, when a team of researchers found a cache of dentate-stamped pots at a place called Lapita

in New Caledonia, a French collectivity to the southwest of Vanuatu. More than 200 sites eventually turned up nearly duplicate versions of this innovation across an enormous span of the region. The pots were often found with particular varieties of preserved plants and nuts, as well as stone adzes. Whoever made those pots some 3,000 years ago had traveled across more than 2,000 miles of ocean — from near Papua New Guinea to Tonga and Samoa — in perhaps as little as 10 generations. As Patrick V. Kirch, the dean of American archaeology in the Pacific, once put it, "Without a doubt, the Lapita colonization of Remote Oceania ranks as one of the great sagas of world prehistory."

Where had this "Lapita" culture come from, and who were the people associated with it? Over the last 50 years, a collaboration among archaeologists, linguists, botanists, ecologists, geologists and more had produced some form of consensus. A population of early farmers departed from Taiwan about 5,000 years ago, with the help of the newly developed outrigger canoe. They moved down through the Philippines and the Spice Islands, along the northern coasts of New Guinea and eventually out to the Bismarck Archipelago, more or less the limit of Near Oceania; the "tracer dye" for their path was the language family they left behind, one known as Austronesian. Along the way, they encountered populations of "Papuans" — a generic shorthand for highly distinct groups of people who had been in the Papua New Guinea region for 40,000 years. The interactions between the incoming "Austronesians," another shorthand for whoever was presumably spreading those languages, and the indigenous Papuans created the constellation of practices that would become known as Lapita. Finally, the people now associated with Lapita sailed into the blankness of the open ocean for the first time, crossing the Remote Oceania divide to Vanuatu and, from there, outward to the farthest reaches of the Pacific.

Archaeologists differed, often bitterly, on the details, but as Reich describes it in his book, the prevailing opinion was that "the Lapita archaeological culture was forged during a period of intense exchange between people ultimately originating in the farming center of China (via Taiwan) and New Guineans." This certainly made intuitive sense. The people of contemporary Vanuatu are black, like the Papuan

people of New Guinea, but they speak Austronesian languages that can ultimately be traced to Asia. Reich believed that the existing consensus was the perfect sort of hypothesis to put to the ancient-DNA test. The Austronesians and the Papuans had been separated by at least 40,000 years of genetic differentiation, which meant that it would be very easy to discriminate by genetic signature. Would the samples taken from the skulls at Teouma show a closer relationship to the people of nearby Papua or the people of distant Asia?

In October 2016, the paper — with such well-regarded Pacific archaeologists as Stuart Bedford and his mentor, Matthew Spriggs of the Australian National University, among the 31 authors — was published in Nature as “Genomic Insights Into the Peopling of the Southwest Pacific.” The analysis of ancient DNA from three 3,000-year-old skulls from Teouma, along with one skull dated a few hundred years later from Tonga, appeared to provide unambiguous confirmation of Lapita heritage. The First Remote Oceanians, as the paper calls them, were not, after all, a heterogenous group; they were of unmixed Asian descent.

A mural in Port-Vila depicting life in Vanuatu before Western influence set in. David Maurice Smith for The New York Times

The paper suggested that the old archaeological consensus — that the Lapita advances reflected the joint contributions of Austronesian and Papuan peoples — could be replaced by a much starker story. The genetic record can be more "parsimoniously explained," the authors remark, by at least two *separate* migrations to Vanuatu: first, the Austronesians, with their East Asian ancestry, and then, hundreds of years later, the Papuans. This wasn't a story of "admixture" but one of successive waves of migratory "turnover."

These results were published two years earlier, but as we sat in his silent office, Reich still betrayed some enduring wonder at his revelation. He reminded me that he hadn't been trained as an archaeologist and had thus come to these debates as an outsider. In the broadest conceptual terms, though, he saw the lessons of this once-enigmatic Lapita migration to be exceedingly profound. "I think the

important finding for archaeologists and for historians and sociologists and anthropologists is that this group moved thousands of kilometers over many hundreds of years, through a region occupied by long-established, sophisticated people, and hardly mixed with them." He observed that "essentially everybody was surprised." They were surprised, in part, because archaeologists since the 1960s had been trained never to assume the purity or coherence of a people, a slippery slope to the conclusion that certain peoples came by their advantages "naturally."

But the data seemed indisputable. "Now we can establish that definitively. That's what this technology allows us to do. And then they" — meaning all those other disciplines, which heretofore had overseen the study of prehistory — "can get on with answering what really matters, which is try to interpret what happened."

He paused. "But I think that basically everybody, almost without exception — except for very extreme people — is excited about this data in archaeology."

PART II

6. The Storm Beneath the Surface

The primary characteristic of the deepest reaches of the past, especially for the sort of observer whose paramount concerns are those of the present, is the accommodating silence found there. The quieter an epoch on its own terms, the more loudly it can be made to speak, in the way of a ventriloquist's dummy, for ours. The study of ancient peoples — or of the "primitive" ones often taken to stand in as their contemporary proxies — has been framed by our preference for simple, just-so stories of origin and trajectory. Archaeologists, who feel as though they learned this lesson long ago, thus survey the rapid rise of ancient DNA with an overwhelming sense of déjà vu. By once again giving "migration" pride of place in the story of prehistory, paleogenomics has resurrected some old intellectual ghosts.

By the time radiocarbon dating had come of age, in the postcolonial ferment of the 1960s, archaeology was already primed to relinquish its emphasis on narratives of migration. In the 1910s, a German named Gustaf Kossinna turned his personal fixation on heightened Proto-Germanic Barbarian activity after the fall of Rome into a theory, "settlement archaeology," that emphasized the glory of the German nation. For Kossinna, a given material culture — a uniformity in pottery style, say — was the index of a coherent people, and it was the destiny of the Germans, greater than even that of the Romans, to extend their superior Aryan culture from their homeland to the ends of the earth. The Nazis were more than happy to put these claims into service, and even academics with better politics became convinced that the driver of human progress was the roving exogenous shock of migratory adventures. As Colin Renfrew described it: "Prehistory was seen as a kind of global chessboard, with the various cultures as pieces shifting from square to square. The task of the archaeologist was simply to plot the moves — or, in other words, trace the path of the 'influence' as new ideas were diffused."

The brutal ramifications of settlement archaeology, when combined with the dramatic introduction of radiocarbon dating, shook the entire discipline to its foundations. The disruption was so major that the profession felt it had to rehabilitate itself as the "New Archaeology." This new generation of practitioner agreed that just because similar pots were found in various places didn't mean they were all made by one homogeneous group of people. Instead, archaeologists retreated to a much more modest and fine-comb preoccupation with what they called the "processual": very particular inquiries into very particular societal dynamics. They paid much closer attention to how individual cultures appeared to change and grow over time and much less attention to how Culture Had Changed — to the fantasy that some special key will unlock the secrets of history. This left a big-picture vacuum that paleogenomicists like Reich have been eager to fill.

The resulting schism has been easy to caricature as the old struggle between hard scientists and humanists — a suspicion of all geneticists as quantitative imperialists, a derision of all archaeologists as sentimental Luddites — but that isn't quite accurate. Many archaeologists are thrilled about the arrival of the first

genuinely new form of prehistoric data in generations. The more meaningful division is between two alternate intellectual attitudes: those bewitched by grand historical narratives, who believe that there is something both detailed and definitive to say about the very largest questions, and those who wearily warn that such adventures rarely end well.

Archaeologists shouldn't necessarily care. They remain theoretically free to continue doing things at processual pace, paying thorough attention to historic context and indigenous sensitivities. Even those who are enthusiastic about ancient-DNA research — not only for the new data it provides but for the vigor it has brought to their field — could in principle choose to partner only with geneticists who respect their priorities and expertise; after all, they are the ones who dig the samples out of the ground, and nobody is forcing them to surrender their treasures at gunpoint. Collaborations between geneticists and archaeologists on an even footing have produced well-received studies that plot, say, the family trees in a medieval cemetery.



A human petrous bone being analyzed at the Max Planck Institute for the Science of Human History in Jena, Germany. David Maurice Smith for The New York Times

But in practice, the paleogenomicists have totally altered the environment in which prehistory is being studied by everyone. The landscape is dominated by four well-funded, well-connected labs, three of which — Paabo's in Leipzig, along with those of two of his protégés, Reich at Harvard and Johannes Krause, who runs a newer outfit in the small German city Jena — collaborate closely with one another, to the point that some critics accuse them of collusion. The power of these top labs extends to samples, data and even technology: Proprietary chemical reagents let them isolate and enrich ancient samples much more accurately and cost-effectively than other labs can. One geneticist compared competing with the big labs to battling an entire navy "with a little dinghy, armed with a small knife." Another told me: "A small lab focusing on a particular site would not be able to place their work

in the context of the bigger picture. The only way I can get access to that data is if I give my bone to David or Johannes and wait until they process it — and bury me in the list of contributors to their paper."

The selective pressure to collaborate with this state-of-the-art oligopoly is extremely strong, not only because of their advantages in funding, speed and operational scale but also because of the relationships they enjoy with the top-tier journals. Publication in a title like Nature or Science can utterly transform a young scholar's career, enhancing both the prospect of tenure and the ability to secure grant funding. The rush to corner the market on old bones in some "understudied" place or time period has placed a high premium on virtually all samples, creating perverse incentives for researchers to procure these scarce, nonrenewable resources. The only entry fee for a 27th or 53rd author slot in this "free-for-all bonanza of Nature papers" (as one geneticist described it to me) is the cost of a bone shipment and a minimal account of its basic archaeological provenance. Multiple researchers told me that it wasn't unusual for junior authors to be given just days to review a finished manuscript, with little input into its broader framing. (Reich, Krause and Paabo all dispute this, saying they couldn't think of any examples in which co-authors were given such a short time to review a manuscript.)

There thus reigns, in the world of ancient DNA, an atmosphere of intense suspicion, anxiety and paranoia, among archaeologists and geneticists alike. In dozens of interviews with practitioners of both disciplines, almost everyone requested anonymity for fear of professional reprisal. Many archaeologists described a "smash and grab" culture in which hopeful co-authors source their bones by any means necessary. Among teams at work on any given excavation, it takes only a single colleague to deliver a bone to one of the industrial giants for the entire group to lose control of their findings. Museums, too, are being swept up by the perverse incentives: One of the geneticists told me stories about having brokered an agreement to sample a particular collection, only to arrive and discover that someone else showed up the previous day to claim the same bones under a false pretense. The weaker the institutions of the country, the harder it is

for local researchers to have a fighting chance. Scientists in Turkey and Mexico told me that museum curators routinely had to explain that they had promised their native bone collections elsewhere. As one ancient-DNA researcher in Turkey put it to me, “Certain geneticists see the rest of world as the 19th-century colonialists saw Africa — as raw-material opportunities and nothing else.”

(Reich, Krause and Paabo strenuously denied the characterization of their labs as colluding in a manner that harms competitors. Krause noted that his lab employs students and scientists from 30 nations and supports foreign researchers. Reich commented via email: “The fact that the substantial majority of the world’s human ancient DNA data has been produced by a small number of laboratories is not because of any special access to samples, but rather because of the high quality of work these laboratories deliver.”)

It has not gone unnoticed that the stunning, magisterial sweep of genetic revisionism, on the one hand, and a genetic emphasis on radical prehistoric migrations, on the other, bear more than a little in common. Some anthropologists and archaeologists accept this analogy with gallows humor. One told me that I should model this article after the format of the standard Nature paper: “Ancient DNA Reveals Massive Population Turnovers in the Humanities,” she suggested as a title, and proposed this as an abstract: “The aristocratic lab scientists arrived with their superior technology and displaced the pre-existing researchers and their primitive truth-implements and overcomplicated belief systems.”

Others saw less to laugh at. Some archaeologists who had collaborated on the 2015 paper about Indo-European invasions withdrew their names to protest conclusions they saw as echoes of Kossinna — the mass migrations of advanced Indo-Europeans into Central Europe. (Reich got the critics back on board by adding a note, on Page 138 of their paper’s 141-page supplementary materials, that said their work in fact contradicted Kossinna, not because he was wrong about mass migration but on a technicality: The European ancestral homeland had, in fact, been far to the east, near the Caucasus and nowhere near present-day Germany.) The analogue was hard to counter. Geneticists had indeed swept down from their

laboratory enclaves to extend their sovereignty over what had always been the terrain of archaeology. And no single individual had as much influence or power as Reich.

7. The Postage-Stamp Problem

Migration in the Pacific had never been quite as fraught as it was elsewhere; the people had obviously shown up from someplace. Or rather, this had been obvious to outsiders, if not to the locals. Upon our return from the Teouma overlook, Bedford went off to catch up on village gossip, and I sat with Chief Alben in the shade of a stout, leggy banyan tree, its exposed root system rising from the earth like a half-exhumed skeleton. Alben is a hale and jovial older man with a round paunch and a push-broom mustache. For years, he has participated in a volunteer fieldworker program that trains the ni-Vanuatu to record and preserve their local traditions amid the creep of global monoculture and to pay attention to the sorts of archaeological finds they might otherwise ignore.

I asked him about how the concept of Lapita migration to empty islands had been received by people whose oral traditions said they came from a stone or a coconut tree. After the Teouma find, the national post issued a special commemorative stamp — “Lapita People: The Pacific’s Original Explorers” — with an artist’s recreation of a colonial Eden that showed men and women, drawn black to resemble the ni-Vanuatu, cleaning fish and making camp, and Bedford printed pamphlets for schoolchildren that explained that the Lapita were the grandfathers of grandfathers of grandfathers. Now Reich’s research had raised the prospect that they bore not even a passing resemblance to Vanuatu’s earliest settlers.

In the wake of the initial discoveries at Teouma, Alben replied, he explained to his villagers that there was nothing surprising in the fact that the grandfathers of grandfathers of grandfathers had once come from someplace else. “Our *kastom* teaches us that people moved from place to place to place,” he told me. *Kastom* is an expansive concept that includes tradition, history, land rights and social norms;

local *kastom* varies tremendously across the more than 80 islands of Vanuatu, but the notion itself has become sacrosanct for the continuity and authority it provided in the aftermath of colonial occupation.



A technician at the Planck lab in Jena. David Maurice Smith for The New York Times

Alben told me he had been stymied by the practicalities, though. “Maybe these Lapita people came from Asia! How? How?! How can these people come here?”

He waited for me to answer, but it wasn’t clear what he meant; I shrugged and ventured a timid, “Canoe?”

He shook with laughter at such a painfully obvious answer. His question was not about what they used to cross the water but how they founded a way of life that endured until today. “They took the coconut” — he pointed off to his left — “and they took the breadfruit” — he pointed off to his right — “and they put it into the

canoe. When the canoe lands, they plant." The people, in other words, were tied to the land by what they had brought with them. On the road out of Port-Vila, I'd made an idle remark to Bedford about the primeval greenery around us; he corrected me to say that what looked like jungle was actually under heavy cultivation.

The ni-Vanuatu were not accustomed to thinking about history for its own sake, instead expecting that any story you told about the past necessarily gave form and guidance to the present. If *kastom* told you that your people came from a stone near the lagoon, that was relevant for ongoing disputes about who now deserved to till that land. The idea that in some abstract, scientific way they were "really" from somewhere else didn't mean anything unless there was a direct contemporary moral.

They did know, however, that what had often been presented to them as abstract scientific knowledge routinely concealed some practical agenda. The first European explorers in the region, even if they weren't quite so forthrightly instrumental about it, also interpreted the history of the South Seas to suit their own contemporary concerns — both imperial and philosophical. Pacific Islanders, marooned in what were seen as the natural laboratories of primal isolation, were enlisted as the "noble savages" of Enlightenment fantasy. The question of who they were and where they had come from became lively topics. Some ventured that they were refugees from the Lost Continent of Mu. Others tried to classify them in a way that would accord with their own pet-scientific notions of cultural evolution. The French explorer Dumont d'Urville, who first sighted Vanuatu in the 1820s, proposed a tripartite scheme that unfortunately endured: There were the Polynesians ("many islands"), the lighter-skinned people who inhabited an enormous triangle of the Eastern Pacific bounded by Hawaii, New Zealand and Easter Island; the Micronesians ("small islands"), who lived on the atolls of the Western Pacific north of the Equator; and, always finally, the Melanesians ("dark islands"), the dark-skinned people east of New Guinea who spanned the divide between Near and Remote Oceania. Europeans fixated on the differences between

the Melanesians and the Polynesians, imagining the Polynesians as a kind of laggard aristocracy, comparable to the ancient Greeks, and the Melanesians as naturally backward black people.

And so, when it came to the question of how ancient peoples had populated the Pacific, the most persistent proposals rested on racial typologies. The Melanesians obviously came from in and around Papua, which was relatively nearby and inhabited by “savage” black people, whereas the lighter-skinned and more “advanced” Polynesians probably sojourned via heroic open-sea navigation from Asia. Anything “superior” — technology or social structure — was linked to the migratory intervention of exceptional groups from distant shores. The European colonial enterprise was thus justified as part of the natural relationship of incoming enlightenment and indigenous savagery.

The ni-Vanuatu are not unaware of the region’s racialized history, or of its racialized present. As Bedford and I drove back to town, the only visible graffiti was a reminder of regional Melanesian pride: “Free West Papua,” a show of racial solidarity with the black residents of the western half of New Guinea, a persecuted colonial possession of Indonesia since the early 1960s. A new sort of colonial anxiety, meanwhile, is manifesting itself about the Chinese, who have been investing heavily in the country. The old shops on Port-Vila’s main harborside drag have been replaced by cheap Chinese joints hawking souvenir ukuleles, and the new luxury-condominium developments above downtown advertise “Hong Kong Apartment-Style Life” over images of white and Asian people in infinity pools.

Bedford and his archaeologist colleagues on Vanuatu are known for their long tenure in the country and their keen acquaintance with local sensitivities, and it was only on their bond that the Teouma petrous bones were sent abroad for sandblasting. Now their names were on a genetics paper arguing that the ni-Vanuatu’s ancestors were not Lapita after all, but latecomers to an archipelago first settled by purely Asian expeditions.

8. The Ghosts of Peer Review

As it happens, this radical claim was not as definitively accepted as the published paper seemed to show: Serious challenges to its soundness were laid out during Nature's peer-review process. And yet, in a highly unusual move, the paper was accepted over steadfast opposition from two of the three original peer reviewers on its anonymous panel. Confidential documents made available to me reveal deep concerns with the paper's methods and its conclusions.

Among the two objecting reviewers, the methodological critiques — both on the level of archaeological context and that of data analysis — were paramount. "It seems to me that a significant question," Reviewer Two writes, "is whether these individuals were actually 'Lapita people,' assuming that such a thing exists." The paper listed six of the nine skulls found at Teouma, though the team had only successfully extracted ancient DNA from three of them. "In addition," Reviewer Two continues, "it seems clear that these skulls were not related to the 100+ individuals excavated from the Teouma site. That is, the skulls do not fit the bodies. Clearly there was a complex set of traditions around these burials including decapitation at some time before or after initial burial. I am curious as to whether these skulls might have been kept by relatives and only later (perhaps much later) (re)buried at Teouma," a tradition among some indigenous groups.

Even if the skulls were the same age as the rest of the bones at the cemetery, there was still the matter of how oddly they had been interred — one inside a jar, the others arrayed like a shield across another skeleton's chest. "This seems to suggest," Reviewer Two adds, "that the three people were special in some way. Hence I am concerned about drawing too many conclusions from such a small number of individuals plus individuals who were certainly not a random sample of the population." Shouldn't the collaborating archaeologists have pointed all this out?

The study's authors, the objecting reviewers insist, had made disproportionate or even wholly unwarranted claims on the basis of both the archaeological and genetic evidence they had provided. Yes, the Teouma skulls came from an

important site, and yes, the new data they provided was a fascinating additional piece of evidence. But they still just represented three samples from one site on one island, and the objecting reviewers noted that Reich's inferences could have been skewed by what one of them called "bias in the method" — the set of assumptions necessitated by his complex statistical models. Meanwhile, the contemporary samples they used for historical comparison weren't even from Vanuatu, but from potentially unrelated regional communities used as proxies. "In my opinion," Reviewer Three wrote, "this paper does not merit a significant advancement over current studies and the lack of detail regarding basic data description is frustrating."

The paper's purchase on significance, then, seemed to have less to do with its originality than with its certainty. The title of the first submission was "Ancient DNA Documents Multiple Human Migrations Into the South Pacific," and it presumed to offer the final word on the history and ancestry of an entire region. Three contemporaneous samples might be sufficient for a modest paper about the Teouma site, but modest papers about one archaeological site in Vanuatu are not the sort of thing Nature is in the business of publishing. "In the light of these various comments," an editor wrote to the reviewers, "we have declined publication of this study." There is a clear distinction, at Nature and elsewhere, between a rejection and a call to revise and resubmit. "Rejection means rejection," one geneticist told me, "and rejection is final."

Yet the Reich team proceeded to revise. They were aided in this by their colleagues at the Max Planck Institute for the Science of Human History, in Jena. Its director of archaeogenetics, Johannes Krause, had worked alongside Reich in Paabo's lab. When the Jena team heard that the Oceania paper had been found wanting for further regional samples — samples that would allow them to expand their claims beyond simply Vanuatu — one doctoral candidate remembered that their inventory contained a stray petrous bone from a site in Tonga, one already found to contain readable DNA. It was, fortuitously, highly relevant to Reich's Oceania work, and the data was forwarded along in due course.

Johannes Krause, who runs the Planck lab in Jena. David Maurice Smith for The New York Times

On the basis of this single additional ancient bone, the Reich lab resubmitted their paper, and a fourth reviewer was added to the panel. The revision addressed very few of the objecting reviewers' concerns, and the changes it did provide struck those reviewers — who were asked, to their surprise, to review the revision — as perfunctory and weak. "The analysis and data generation presented herein, in my opinion," Reviewer Three ultimately concluded, "simply does not merit a Nature-level manuscript." Nevertheless, the paper was accepted.

When pressed about the peer-review process, Reich told me his reply to the initial round of concerns had been "the most robust, powerful, compelling response we've ever given to a set of reviews. We completely answered absolutely every question

very robustly; there was not a single point in those Reviewer Two and Three comments that had any validity and that we were not able to fully and powerfully answer." When I noted that the objecting reviewers had not been convinced by their counterarguments, he said: "The fact that a person who sends a review doesn't feel like their arguments have been answered doesn't mean that they haven't been answered. I felt that those reviews were not compelling reviews, didn't make sense, didn't take into account the actual evidence that we had brought to bear properly and were completely addressed by our response, and the journal agreed."

He acknowledged that it was rare for journal editors to overrule their referees. "This was a case where the reviewers were making egregious errors," Reich said. "These were problematic reviews that should have been discounted because of their problematic nature, and we were able to successfully make that case on very good grounds, and the editor agreed with that in the course of the review process. And it's a very rare thing." (A spokesperson for Nature said in a statement, "For confidentiality reasons, we cannot discuss the editorial history or review process of any Nature paper with anyone other than the authors.")

At the end of our conversation, Reich returned to his Vanuatu effort, waxing unsolicitedly about his personal attachment to the finding. "That paper is such an important paper. It's such an important observation, such an important measurement — it's exactly the type of thing that needs to be published in that type of journal. It's in the class of an unrejectable paper."

9. The Seductions of 'Migration'

In Reich's view, quibbles about which skull did or did not fit which skeleton in an ancient tropical cemetery in a land he had never visited were entirely beside the point. He was doing large-scale, broad-brush work, and it was up to the archaeologists to add their fine filigree of detail. Even if you accepted the paper's broad-brush results, however, most archaeologists find this distinction misleading. The problem wasn't that he was explaining too much on the basis of too little, but that he wasn't ultimately explaining anything at all; it was all well and good to put

"migration" back on the table, but the concept itself did little to clarify what was actually going on. For example, it was a still a mystery that secondary Papuan migrants had replaced the original settlers but somehow adopted their Austronesian language.

The Jena outfit, evenly split between geneticists, archaeologists and linguists, was set up to address questions of this order, in studies designed to include each discipline's contributors as full partners. The edifice itself is an architectural bricolage, a vaguely Bauhaus-inspired white building conjoined via metal tube to a stately 19th-century villa. The head of the institute's department of linguistic and cultural evolution had decided that his team's flagship project would be a fine-grained 10-year investigation of the "Galápagos of language evolution" that made Vanuatu a "microcosm of all those forces that have generated human diversity."

A young Irish anthropologist, Heidi Colleran, was brought on to help lead the relevant ethnographic field research; just before she left, she and her partner, a British population geneticist named Adam Powell (who also happened to be her collaborator on the project), were asked if they might try to collect spit from the groups she planned to work with, for the purposes of a proper contemporary baseline. Reich had used other modern Oceanic groups as rough proxies in part because no one imagined that any ni-Vanuatu would ever assent to such a study. Stuart Bedford, who had been brought in on the Jena project, believed that it wouldn't happen in a million years. If outsiders said that spit held secrets about the past, the ni-Vanuatu might worry that those secrets — if these foreigners said they were "actually" from elsewhere, indeed latecomers to their own nation — could nullify their rights to the land. After the publication of Reich's paper, the indigenous Kanaks of "neighboring" New Caledonia declared a three-year moratorium on any genetic research, for fear that their limited sovereignty might be undermined.

Villagers from Alpalak, a community participating in a study of Vanuatu languages being run by the Planck lab in Jena. David Maurice Smith for The New York Times

The Jena team sought the ethical oversight of an institutional review board. Once in Vanuatu, Colleran, along with Powell and Kaitip Kami, the curator at the national museum, pitched their project as a way for villagers to understand where they fit in the family tree of the Pacific; they also promised that, in accordance with best ethical practices, they would return to present the results to the participant communities. To their great delight, they were deluged with willing volunteers. Over the next year, the researchers back in Jena put these results together with data they had retrieved from 19 new ancient samples; after a review period of six weeks, their paper appeared in Nature Ecology & Evolution on Feb. 27, 2018.

While so much of Reich's work has conjured the notion of sweeping, wholesale replacements by one population of another, the Jena paper proposed instead a much more gradual process. Their samples demonstrated not a single decisive

turnover event but at least 500 years of ongoing traffic between Papuans and Austronesians — plenty of time to explain how the former had managed to pick up the latter's languages, for one thing. Whatever happened in that period was clearly complex, but it seemed to them inaccurate to describe it as the one-off snuffing out of one group by another. "The idea that one day there were tons of people in canoes," Krause told me when I met him in Jena, "that's not how we should see it." What Reich was wont to attribute to simple "migration" was just a restatement of the problem of what happened. The actual causal mechanism could have been malaria, or warfare, or volcanic activity, or some competitive advantage in agriculture.

A thought experiment might help to illustrate this. Imagine that the written history of our current era were lost to time, and paleogenomicists of the future were trying to explain the peopling of North America on the basis of a few bones that dated from between the 16th and 20th centuries. If these bones included the descendants of British, Spanish and French colonists as well as those of Yoruba slaves, the researchers might conclude that European migrants arrived together with African migrants and that their "sex-biased admixture" created the people known henceforth as Americans. From our perspective, those geneticists wouldn't exactly be wrong about all this — but nobody would accuse them of being right, either.

There's no particularly good reason to believe that the past was significantly simpler than the present, and archaeologists have come to believe that the more digging they do, the more complexity they uncover. It makes sense that they would resist simple explanations. From Reich's perspective, this archaeological truculence represents a stubborn attachment to the old, complicated stories in the face of new molecular data — just as some archaeologists held fast to their tall tales despite what Renfrew called the "mysterious boffinry" of radiocarbon dating. The analogy, however, doesn't quite work. This time the scientists have arrived with their advanced technologies not to dismantle theories of coherent "cultures" who "migrated" from "homelands" but to revive them — without any disciplinary memory of the traps involved or the stakes of failure.

Over the course of 2017, Reich was working on his own competing follow-up, though by the time the Jena team submitted its completed paper to journals he had barely begun to compose his own. (Reich, who told me he could not remember the specific timeline, said, “The whole analysis was mature; we basically had the key findings already — we were just slow in writing it up, because we were overextended.”) The two labs had briefly contemplated collaborating, but in May 2017, the Jena team vetoed the idea, one of its leaders told me, because Reich wanted too much control. So the projects advanced separately. Reich tried unsuccessfully to get contemporary ni-Vanuatu spit from other researchers until he learned of some blood samples, drawn decades ago by medical researchers and now held in trust at a repository at Oxford. The Reich team obtained permission to resequence the old samples for their own purposes — even though in gray-area cases like these it is never at all clear who holds the authority to retroactively license the use of vital fluids taken when ethical protocols were considerably more lax. He also had 11 new “ancient” samples, though six of them were from only about 150 years ago.

Reich submitted his manuscript to the journal Current Biology on the same day that Jena’s paper was accepted by Nature Ecology & Evolution. One week later, on Feb. 19, the paper was accepted and given an online publication date of Feb. 28 — one day after the online publication date the Jena team had been given. Peer review and acceptance of a paper in a week was in itself an unprecedented feat; not a single person I talked to in the field could think of a similar case. Reich conceded that it was uncommon. “It was the fastest review we ever had,” he told me, “but it was actually a very high-quality review. It was better than most reviews we got. It was actually a serious review, a very serious review.” Some other geneticists doubted it; one said to me: “There’s no way there’s proper peer review there. That’s an egregious violation of scientific norms.” (“The Reich paper was properly reviewed by three relevant experts, all of whom recommended publication with minor requests for revision,” the Current Biology editor in chief, Geoffrey North, said in an emailed statement, crediting the turnaround to

reviewers who made the paper a priority.) Even so, publication on successive days was apparently not a satisfactory outcome. On Feb. 19, Reich's paper appeared in preprint form on the web, eight days before the Jena effort came out.

A technician collecting a petrous bone from a UV light box at the Planck lab in Jena. The items are bathed in UV light to eliminate foreign DNA contamination. David Maurice Smith for The New York Times

While the Jena samples showed at least 500 years of Austronesian-Papuan mixture, Reich's follow-up argued — on the basis of a single sample from a single island — that the First Remote Oceanians had been replaced by at least one wave of belated Papuans. Otherwise, the paper had little to add. Reich had, however, updated his analysis of the original skulls with improved, "higher-resolution" statistical techniques. One new data point, which Reich saw as a refinement, struck some critics as a significant revision: While Reich emphasized to me in his office that the first paper conclusively demonstrated no mixture between the Austronesians and the people they encountered, the updated analysis showed that

Teouma's "Lapita individuals had a nonzero proportion of Papuan-related ancestry." It "remains striking," the new paper remarked, that these first migrants were only "minimally admixed" — but admixed they were.

10. The Archaeologist's Dilemma

Day's end in Port-Vila is colored by the process of selecting which kava bar to patronize; each imports its kava from a different island, and friendly arguments about kava strength and quality are common. On our return from Teouma, Bedford and I met up with an extended crew from the national museum for kava grown on the volcanic slopes of the northern island of Ambae, where an eruption threatened to stop shipments. Kava is a cloudy green tonic, served in little miso bowls meant to resemble coconut shells. The custom is to collect your shell, retire alone to the cover of a nearby shadow, take the entirety at one draft and then spit the particulate remnants; by nightfall, when even the city is blanketed in thick dark, the only regular sounds are the screech of the fruit bat and the hock of spit.

I sat in the dark next to Frederique Valentin, a French bioarchaeologist who was an author on Reich's original Vanuatu paper; it was she who made the final contribution that rescued the effort, the Tongan petrous bone. As it turns out, in 2015 she submitted a manuscript to Nature that made an almost identical argument to Reich's. She had reached the same conclusions upon examination of the cranial morphology of the exact same skulls, which she believed more closely resembled those of Asians than those of Papuans. But her paper was rejected by Nature. As far as she or many others could tell, the only difference between her conclusions and Reich's were those of methods — hers old, theirs shiny and new — and rhetorical grandeur. I asked if she thought that Reich's definitive statements about Lapita origins were warranted.

"A small sample," she replied, "is only representative of itself."

The controversy over paleogenomics was becoming a near-ubiquitous presence in archaeology journals, and Bedford, as an author on all three Vanuatu papers, had recently written the introduction to an academic forum on the subject, in the

journal Archaeology in Oceania. The evident differences between the two competing follow-ups put him in a bit of a bind, because his name was on both of them. “Both papers,” Bedford maintained, “arrive at a similar conclusion,” that initial Austronesian settlement was followed by a Papuan gene flow. But as the introduction continued, it became increasingly clear that he could not, in fact, at all believe that both could be right, and he tipped his hand in favor of the Jena paper, with its emphasis on an “incremental and complex” process that accorded much better with the artifactual record as he had spent his career understanding it.

The contradictions of Bedford’s introduction — in which he said that both papers could be right but that the complicated one was probably more right than the simplistic one — felt less like an equivocation than it did a form of subtle apology. As one contributor to Bedford’s forum observed, archaeologists had told the ni-Vanuatu for decades that they were the descendants of the Lapita voyagers; now they had to go back and advise them to alter the commemorative postage stamps to feature not black people but Taiwanese aboriginals. A national self-image was not something to take lightly. “One can only feel,” one forum contributor wrote, “a collective sense of betrayal in all of this.”

Some critics believed that any association with Reich represented a betrayal, too, not only of the ni-Vanuatu but of anyone who believed that culture was as powerful a human determinant as the gene. Shortly before the publication of his book, Reich wrote an Op-Ed in The New York Times in which he warned that the future was likely to demonstrate some meaningful genetic differences among populations and that we needed to be honest about such truths, lest they be abused by racist pseudoscience. He was careful to differentiate the idea of a genetic population from the old idea of race, which he agreed was a social rather than biological fact. But he nonetheless gave comfort to those who maintain that on the deepest of all levels our destiny is written into our genetic signature. It was hard not to see that conviction reflected in the findings of Reich’s papers, which seemed to blithely recapitulate discredited theories of Pacific expansion, making categorical claims

not only about four individual skulls but about the shape of human history — claims that were essentially indistinguishable from the racialized notions of the swashbuckling imperial era.

Younger scholars who don't think that the big, powerful labs are exhibiting proper respect, sensitivity and historical consciousness — including anthropologists like Heidi Colleran, who went to great lengths for ni-Vanuatu spit — are thus put into impossible positions of tragic compromise; they face the decision to spend their careers as access mercenaries, to work with smaller outfits that get pushed aside or scooped, or to get out of the field entirely. As Colleran would put it to me later: "When any fieldworker talks to collaborating communities in the field, they are putting their professional and personal integrity on the line, their own legitimacy, often in a completely different line of work, for these samples. And once they are out of your hands, you have very little control. That's a gamble for anyone doing long-term fieldwork." She expressed reluctance to take part in any future studies in which the paleogenomicists alone set the pace. Her population-geneticist partner, Adam Powell, feels the same way. "I really wanted for us to do things differently," he told me, "but didn't think it would be this hard. I'm now going to focus my energies elsewhere."

The day after our night out at the kava bar, Colleran booked us on an Air Vanuatu flight to the northern island of Malekula to visit a remote village called Alpalak, which was roughly translated for me as "the place where if you go you will definitely die." There she introduced me to Chief Jimmyson Sanhambath, who sat and drank kava with me in the shifting shadows of a mango tree, heavy with unripe fruit. Sanhambath is an exceptionally vital man in his late 50s, with a slender, wiry physique, a thickly corded neck, and a long, smooth forehead and sharply angled jaws knitted together by a trim graying mustache. Asked about the spit that his people had given Colleran, he told me he had come to believe that there couldn't be anything in it; spit evaporates to nothing, after all. He admired Colleran and didn't want to trifle with her work, he insisted, but he continued with a mischievous grin, "They must just be making it up."

The next day, he took us through bamboo thickets to see some of the oldest cave art in the region. We crouched down through a dark opening, followed a short slope and emerged into a large, well-lit chamber; a single banyan had snaked its way up and through a skylight opening high above. As we passed into the midday twilight of the rear of the chamber, Sanhambath pointed out dark handprints of a mossy jade color high up on the smooth walls. Nearby were crisp figures with the heads of dogs and pigs and the bodies of men; they wore unmistakable versions of the penis sheaths associated even today with Sanhambath's community.

Archaeologists said they were made by men who ate charcoal, chewed it up and spat it back onto the walls. The oldest dated back 2,600 years and looked at once hauntingly archaic and vividly recent. "They're not Lapita," Sanhambath said, gesturing at the drawings, which had been dated by radiocarbon to shortly after the Lapita period ended. "But so what?" Besides, as much faith as he had in what the archaeologists said about pottery or bones, he just couldn't bring himself to believe them when they said these paintings were made by ancient men.

"These paintings," he said quietly in the cave dark, "were made by the spirits."

Corrected on Jan. 25, 2019: An earlier version of this article misstated the number of peer reviewers who evaluated the 2016 Nature paper "Genomic Insights Into the Peopling of the Southwest Pacific" before publication. It was four, not three; a fourth reviewer was added to evaluate the paper after the original submission was revised. The article also misstated the geographical area where migrants from the steppes of eastern Ukraine and southern Russia significantly replaced existing communities of hunter-gatherers and early farmers, as reported in an academic paper on the migration. It was Central and Northern Europe, not the entire continent.

We acknowledge mistakes in our reporting with corrections. If you spot an error, please let us know at corrections@nytimes.com. Learn more.

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